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goods-engines.' The steam-cylinders were inside the frames. The forward wheels were coupled, instead of, as usual, the after-wheels; thus getting a set of small trailing-wheels, short outside coupling-rods, and a large boiler. The centre of gravity of the engine was purposely made high, as is the practice in this country in the construction of the wide-firebox engines of Mr. Wooten, for the purpose of making the engine move more easily at high speeds, and, as both these designers believe, making them safer; the rolling being less serious at exceptionally high speeds than in engines having a low centre of gravity. The action of the high centre of gravity in throwing the pressure mainly upon the outer rail, in rounding curves, was thought to be another advantage of appreciable value, permitting the inside wheels to slip more readily. Six wheels were used, without truck or 'bogie.'

It was asserted that the cranked axle, and other parts of the machine, do not break if properly proportioned, although it was evidently felt that the axle is a source of danger in greater degree than when straight, as in outside-connected engines. The steam was given an admission varying from twelve to seventy-eight per cent, the engine running very smoothly, and with great economy, at high speeds, with the shorter cut-off. The compression is thus made advantageous in both ways. It was considered that compounding would not be of sufficient advantage to justify its adoption in such engines; although it might prove useful for heavy, slow-moving engines, working with little expansion the greater part of the time. The Westinghouse brake was fitted to all these engines, and gave thorough satisfaction. Its pump had been fitted with a water-connection, and it could thus be utilized as a boiler-feeder when on sidings. The boiler was made of Yorkshire iron, with joints butted, edges of sheets planed, holes drilled after bending the sheets, and all hand-riveted. The steam used amounted to about twenty-six pounds per horse-power per hour, on a road on which the average is thirty. One pound of coal conveyed one ton thirteen miles and a half, at the speed of 43.38 miles an hour. Heating the feed-water saved two pounds and a half per train-mile.

SEMI-CENTENNIAL OF THE LYCEUM OF NATURAL HISTORY AT WILLIAMS COLLEGE.

It will be news to many, that a natural history society of college students has had an uninterrupted existence of fifty years at Williams college, in the little village of Williamstown, Mass. It is nevertheless true, and its semi-centennial was celebrated on April 24.

The exercises were opened by the president of the society, Mr. Henry B. Ward, with a short historical sketch. "Fifty years ago," said he, "on the 2d of April, eight students of Williams college formed a society for the study of natural history in its various departments. At first secret, under the name of *Φ. B. Θ.*, within six months it adopted its present

name. Professor Albert Hopkins, speaking twenty years later, said that it had sustained from the beginning a spirit of enterprise. The history of its early years remarkably verifies his assertion; for within a year from its formation it was large and active enough to send to Nova Scotia an expedition of twelve members and three professors. This expedition gave the lyceum a considerable reputation, and it was referred to by a French scientific journal as the first of the kind attempted in America. In the spring of 1840, only four years later, an expedition was sent through Berkshire county for study and collecting. By these two expeditions and individual effort, the collections well filled the society's rooms in East college. When that building was destroyed by fire, in 1841, the collections also perished. Contributions from all sides, and hard work by the members, soon restored them so well that the rooms in South college became too small; and in December, 1854 a circular was sent out, forcibly setting forth the needs of the lyceum, and asking for twenty-five hundred dollars to erect a building. This circular was brought to the notice of Mr. Nathan Jackson of New York, a relative of Col. Williams, and grand-uncle of the president of the lyceum at that time. He sent a check for the whole amount; and in a few months Jackson hall was completed. At commencement, Aug. 14, 1855, the lyceum was addressed in the forenoon by Prof. William B. Rogers, and in the afternoon held a public meeting in its new rooms in Jackson hall, to dedicate the building, and celebrate its twentieth anniversary. At this time Mr. Jackson sent a thousand dollars to make up the full cost of the building. In February, 1857, desiring to fill the cases in Jackson hall, the lyceum sent an expedition to Florida. Sixteen members, under the guidance of Professor Chadbourne, spent a month collecting on the Florida shores, with great success. The expenses were provided for by the liberality of Mr. Jackson and other friends of the society. In 1860 another expedition under the charge of Professor Chadbourne was arranged to Labrador and Greenland, a description of which has been recently published by Prof. A. S. Packard, a guest of the lyceum on that trip. In 1867 an expedition under the joint auspices of the lyceum and the college was sent to South America, under the charge of Professor James Orton, a former president of the lyceum. A small party proceeded from the northern coast by the courses of the Orinoco and Rio Negro to the Amazon: the main body crossed the Andes from the western coast, and descended the Amazon in canoes. In 1870 an expedition from both the lyceum and college spent four months collecting in Central America with great success. The expedition of 1877 to the northern Rocky Mountains was broken up by the death of Professor Tenney, its leader, just as it had started.

"Many have been the professors who have aided the lyceum in its work; but to Professor Albert Hopkins, Dr. Chadbourne, and Professor Tenney it owes a debt of gratitude which can never be computed."

Dr. W. K. Brooks, a former president, then addressed the lyceum on Life. He spoke of the age

of biology, the study of life, and said that modern biological study began with Darwin's visit to the Galapagos Islands fifty years ago. "Activity of protoplasm cannot be called life. Vital phenomena are distinguished by what is done, not by the constituents of the organism. There is no necessary connection between life and protoplasm. The common characteristic in all life is education. Life is education, and education is life. Kick a stone and a dog: the difference in the result is caused by education." He then referred to examples of natural difference in life as caused by education, and adjustment by education to varied circumstances. "The common characteristic in all these forms of life, from the highest to the lowest, is education. If, then, life is education, in seeking the latter we are advancing the former."

At the close of the lecture, Dr. Brooks was tendered a reception by the lyceum, at its building, Jackson hall, where letters and speeches from old members showed that their interest was still great.

The lyceum is the only active college society in this country which has its own building. It has now about twenty working-members, and holds its meetings every week, at which reports are given by members appointed in advance, on the subject which they are studying. Since Dr. S. F. Clarke took the professorship of natural history in the college, a strong interest in biology has been aroused in the society.

Among the members who have devoted themselves to science after graduation, the following are the best known: Professor Addison Ballard, '42; Mr. William H. Edwards, '42; Prof. W. D. Whitney, '45; Hon. D. A. Wells, '47; Dr. P. A. Chadbourne, '48; Dr. William Goodell, '51; Prof. Henry A. Ward, '55; Professor James Orton, '55; Mr. Samuel H. Scudder, '57; Dr. R. H. Ward, '58; Dr. E. W. Morley, '60; Prof. F. H. Snow, '62; Dr. G. Stanley Hall, '67; Dr. W. K. Brooks, '70; Dr. E. A. Birge, '73; and Mr. J. S. Kingsley, '75.

THE UNITED STATES AT THE FISHERIES EXHIBITION.

It is impossible to do much more than indicate the contents of this immense volume of over thirteen hundred pages. It is entitled 'Descriptive catalogues'; but, as observed by Mr. Goode, it really partakes of the character of a report on the part played by the United-States exhibit at the London fisheries exhibition, — not only that of the government, but also that due to private American exhibitors. A considerable part of the volume was printed, and distributed to visitors, during the exhibition.

There is a short introduction by the commissioner, followed by some data from the census; a list of forty-two gold, fifty-five silver,

Report upon the exhibit of the fisheries and fish-culture of the United States, made at the London fisheries exhibition, 1883. Prepared under the direction of G. BROWN GOODE. (U. S. nat. mus., bull. 27.) Washington, Government, 1884 [1885]. 8°.

and thirty bronze medallists; beside some fifty other awards to American exhibitors, followed by a report on the collective exhibits of the U. S. national museum and the U. S. fish-commission. It is needless to say that every branch of the subject is thoroughly presented, either by specimens, models, illustrations, or literature. There is included under these a useful series of catalogues by Messrs. Rathbun (Economic invertebrates, except mollusks), Ridgway (Water-birds), Winslow (Economic mollusks), Brown (Whale-fishery), Bean (Fishes, and illustrations of fishes), Rathbun (Scientific appliances for deep-sea investigation), True (Aquatic mammals), Capt. Collins (Vessels and boats), Earll (Fishing-tackle and appliances), Clark (Fishery products), and Earll (Fish-culture).

The catalogues of birds and fishes are of particular interest and value, apart from their present connection, to all interested in those departments of biology. The catalogues of mollusks and other invertebrates are necessarily much less complete, and are expanded and improved from the centennial catalogues of Messrs. Dall and Rathbun, prepared for Philadelphia.

The volume is a monument of well-systematized labor, but would probably have been more convenient for reference if it had been divided into two volumes. The anthropologist, ornithologist, ichthyologist, fisherman, or manufacturer can hardly fail to find useful and welcome information in these pages; while, by the staff of the commission and museum, the book can hardly be contemplated without a feeling of thankfulness that the period of extraordinary drudgery, apart from their usual and regular duties, which the volume commemorates, is at last entirely over.

PHYSICS OF THE EARTH.

THIS is an admirable book. Dr. Günther, whose thoroughness has been well shown in his earlier writings, makes many physicists, mathematicians, and geographers his debtors by preparing so able a work on the subjects where they meet on common ground; and, if all teachers of physical geography and geology had the good fortune to possess the advanced training that this volume gives and requires, we should hear less from the classical men of the insufficient discipline afforded to the scholars in our secondary schools by their natural-his-

Lehrbuch der geophysik und physikalischen geographie. Von SIEGMUND GÜNTHER. Band i. Stuttgart, Enke, 1884. 10+418 p. 8°.